October 1989

Warm Springs Ponds Proposed Plan

Silver Bow Creek Superfund Site Report

By Montana Department of Health and Environmental Sciences and the U.S. Environmental Protection Agency

Introduction

The Montana Department of Health and Environmental Sciences (MDHES) and the U.S. Environmental Protection Agency (EPA) are seeking comments from the public on the Warm Springs Ponds Feasibility Study and this Proposed Plan to ensure that the remedies selected will meet the needs of the interested public. The Warm Springs Ponds are one of five operable units identified for the Silver Bow Creek Superfund Site. The public comment period extends from October 26 to December 29, 1989.

Sections 113(k)(2)(B) and 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (hereafter "CERCLA"), as amended by the Superfund Amendments and Reauthorization Act (SARA), requires the lead agency to issue a proposed plan of remediation (cleanup) for any site addressed under CERCLA and to make the plan available to the public for review and comment. This Proposed Plan fulfills that requirement. The plan discusses alternatives for controlling contamination associated with groundwater, surface water, pond bottom sediments, tailings and contaminated soils within the boundaries of the Warm Springs Ponds operable unit. The plan presents the cleanup alternative preferred by MDHES (the lead agency) and EPA (the support agency), and the rationale for identifying the alternative. It also provides background information on the site, summarizes site risks and the results of the Remedial Investigation, describes cleanup alternatives evaluated for the site, and outlines the public's role in the final selection of a remedy. The preferred cleanup alternative identified is a preliminary selection and will be made final in the Record of Decision (ROD) after MDHES and EPA have considered the public's comments and any new, significant information received during the comment period. The Preferred Alternative is based on the Administrative Record that has been developed, the remedial investigation reports which characterize the site and discuss the nature and extent of contamination, and the feasibility study, which describes how the various remedial alternatives were developed and evaluated.

MDHES emphasizes that comments are being solicited on all of the alternatives presented in the feasibility study and in this Proposed Plan, not the Preferred Alternative alone. The remedy ultimately selected for the operable unit may be the Preferred Alternative, a modification of it, a combination of elements from some or all of the alternatives, another response action based on new and significant information, or public comments.

Detailed information concerning any of the material included in the Proposed Plan may be found in the remedial investigation and feasibility study reports. These reports have been placed, as have earlier reports, at information repositories. The locations of these repositories are listed on page 16 of this plan.

Additional documentation regarding remedy selection is available in the Administrative Record for the site. The administrative record has been placed at three locations, also listed on page 16 of this plan.*

**Included in the Administrative Record is an outline of a remedial action plan for the Ponds being proposed by the Atlantic Richfield Company (ARCO). ARCO is the identified responsible party for the Warm Springs Ponds.*

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Ponds have a long history

SITE LOCATION

The Warm Springs Ponds operable unit is one of five operable units identified for the Silver Bow Creek Superfund Site. The Silver Bow Creek Site is one of four distinct but contiguous Superfund sites in the Upper Clark Fork Basin area of Montana. The Silver Bow Creek Site begins in Butte and extends approximately 145 river miles to the Milltown Reservoir just east of Missoula.

The Warm Springs Ponds are located within Deer Lodge County, about 27 river miles northwest of Butte, at the end of Silver Bow Creek, just above the confluence of the Mill-Willow Bypass and Warm Springs Creek. The confluence of the Mill-Willow Bypass and Warm Springs Creek is the beginning of the Clark Fork River. The unincorporated town of Opportunity lies at the southern-most edge of the site, west of U.S. Interstate 90 (I-90). The unincorporated town of Warm Springs is at the northern boundary, adjacent to Pond 1 on the west side of I-90. The only incorporated town within the county is Anaconda, approximately six miles west of the site along Highway 48.

The boundaries of the Warm Springs Ponds operable unit are depicted in the figure. The site extends from the intersection of Silver Bow Creek and I-90 upstream of Pond 3 at the south, to the confluence of the Mill-Willow Bypass with Warm Springs Creek at the north. The western boundary is slightly west of the Mill-Willow Bypass (although east of I-90) and the eastern boundary is the interface between marsh vegetation and the foot hills on the eastern edge of the ponds. The site covers approximately 2,500 acres. Its major features include three settling ponds, a series of wildlife ponds, and the Mill-Willow Bypass.

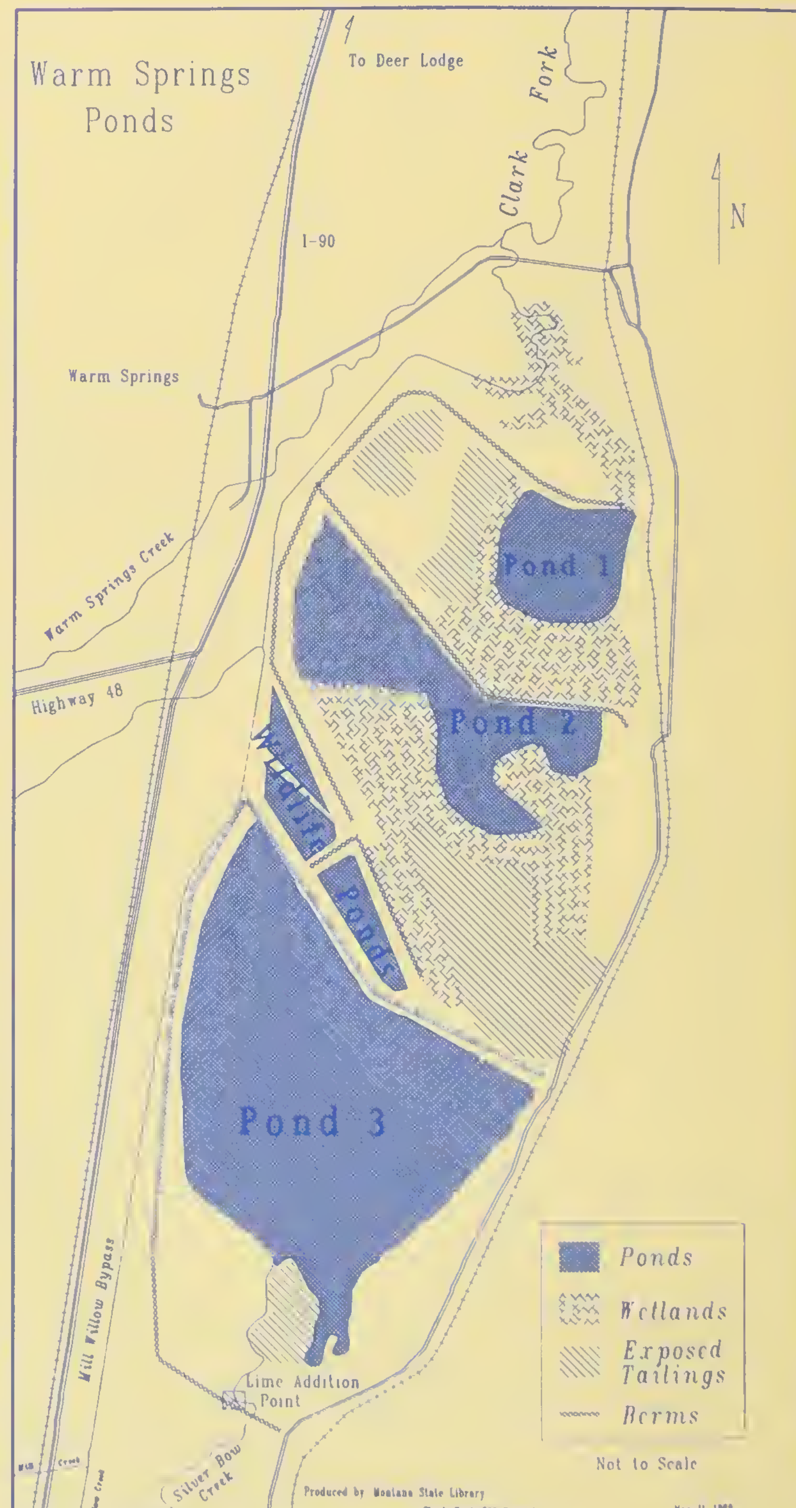
SITE HISTORY

From the beginning of ore concentrating/smelting activities in 1880 until 1911, mining, milling, and smelting wastes from the Butte and Anaconda areas were dumped directly into Silver Bow Creek and were transported downstream to the Clark Fork River, at least as far as Milltown Reservoir, some 145 river miles. Although mining wastes are no longer released directly into Silver Bow Creek, portions of an estimated three million cubic yards of tailings remain deposited along the creek banks where they are subject to erosion and movement down the creek during high flows and floods. Over the past 80 years, an estimated 19 million cubic yards of sediments, tailings and heavy metal sludges have collected in the ponds.

The Anaconda Copper Mining Company (ACM) made the first attempt to control the amount of sediment carried into the Clark Fork River from Silver Bow Creek in 1911 by building a 20-foot high tailings dam on Silver Bow Creek near the town of Warm Springs. This created Warm Springs Pond 1. In 1916 another 18-foot high dam was built at Warm Springs by ACM upstream from the first dam, creating Warm Springs Pond 2. This dam subsequently was raised five feet to a total height of 23 feet during 1967-1969. Warm Springs Ponds 1 and 2 continued to trap and settle out sediment from Silver Bow Creek.

A third and much larger 28-foot high dam was built upstream of Pond 2 by ACM between 1954 and 1959, primarily for sediment control. This structure created Warm Springs Pond 3. The height of this dam was increased by five feet during 1967-1969 to a maximum height of 33 feet.

In 1967, Warm Springs Pond 3 was converted into a treatment facility to treat mill losses, precipitation plant spent



solution from Butte Operations, and overflow from the nearby Opportunity Ponds. Treatment consisted of introducing a lime/water suspension from the Anaconda Smelter into Silver Bow Creek above Warm Springs Pond 3. The addition of the lime suspension raised the pH of the creek water to help precipitate heavy metals in the Warm Springs Ponds. Currently, the ponds are used to physically, chemically, and biologically treat Silver Bow Creek surface water through sedimentation and chemical and biological precipitation of heavy metals.

The current configuration of the Mill-Willow Bypass was constructed about 1969-1970 while making improvements to the Pond 3 berm. The Bypass was constructed to divert what was thought to be relatively clean water from Mill and Willow Creeks around the pond system. Recent information obtained from the remedial investigation indicates that concentrations of metals in these surface waters are higher than originally thought. In 1987 the berm between the Warm Springs Ponds and the Mill-Willow Bypass adjacent to Pond 3 was raised by the Anaconda Minerals Company (AMC) in an attempt to better protect the integrity of the pond system during flood flows.

The Wildlife Ponds were constructed about 1967 by the Montana Department of Fish and Game in association with AMC. The purpose of the ponds was to enhance waterfowl habitat in the upper Deer Lodge valley. Two large cells and several smaller sub-cells and islands were constructed for this purpose. Water within the Wildlife Ponds is treated water from Pond 3, and its quality is generally much improved over the quality of water entering Pond 3.

The Warm Springs Ponds system is operated by Atlantic Richfield Company (ARCO), successor to AMC, and the Montana Department of Fish, Wildlife, and Parks (MDFWP). Pond 1 is currently not used in the treatment process at the site because the pond is largely filled with sediment. However, Ponds 2 and 3 are still used to treat the contaminated water flowing down Silver Bow Creek before it reaches the Clark Fork River. Under current operating conditions, the available storage capacity remaining in the ponds would allow them to be used for this purpose for approximately 70 years.

Ponds are part of a larger picture

Subsequent to passage of the Superfund law in 1980, and following preliminary investigations and assessments, in September 1983 the Silver Bow Creek Site was placed on the Superfund National Priority List. Since then, MDHES has administered and directed the efforts to conduct remedial investigation/feasibility study (RI/FS) activities at the site.

As mentioned earlier, three other sites in the Upper Clark Fork River Basin have also been listed as Superfund sites. These are the Montana Pole, Anaconda Smelter, and Milltown Reservoir Superfund sites. MDHES and EPA identified 25 different operable units at these four Superfund sites. To ensure that the most serious problems would be addressed first, MDHES and EPA prioritized the 25 units into high, medium, and low priority categories. Those operable units with the greatest potential for human health and environmental exposure have received the highest priority for remedial action. MDHES and EPA identified the Warm Springs Ponds as a high priority operable unit.

The Warm Springs Ponds were identified as a high priority operable unit because they are susceptible to flood and earthquake damage, which potentially could release millions of cubic yards of tailings, sediments containing tailings, and metal precipitates into the Clark Fork River causing considerable environmental damage downstream of the ponds. The Warm Springs Ponds are not strong enough to withstand even a moderate earthquake. A 100-year flood could cause extensive damage to the berms supporting the ponds, while a 1,000 year flood or probable maximum flood could result in a general failure of the pond system.

In addition to the potential for catastrophic flood or earthquake damage, the Warm Springs Ponds present significant environmental and human health threats associated with contaminated surface water, soils, and tailings. These contaminated media, and their interaction, have contributed to recurrent fish kills in the Mill-Willow Bypass and the Clark Fork River, the most serious of which occurred in July 1989. An estimated 5,000 fish were killed during that single episode.

The location of the Warm Springs Ponds operable unit, in relation to other operable units at the Silver Bow Creek Site, as well as other sites in the Clark Fork River Basin, played a significant part in determining the remediation alternatives available to achieve a permanent remedy at the Ponds. All threats to human health and the environment at Warm Springs Ponds can be attributed to contamination which has migrated to the Ponds from upstream sources, has passed through the Ponds, or has been deposited within the boundaries of the operable unit. The primary vehicle for the migration of contamination to the Ponds has been, and continues to be, surface water flowing from Silver Bow, Mill, and Willow creeks. Surface water functions to transport other media, such as tailings and sediments to the Warm Springs Ponds. While surface water contamination upstream from the ponds likely will be reduced by future cleanup actions, until then and for the foreseeable future, that surface water will require treatment to reduce its toxicity as it flows downstream into the Clark Fork River.

Some of the contamination at the Warm Springs Ponds is located within the operable unit and either is migrating or has the potential to migrate from the operable unit downstream. Other contamination continues to migrate from upstream sources to the operable unit. Therefore, source control measures in some instances and migration management measures in other instances will need to be used to achieve the Superfund statutory mandate of assuring permanent protection of human health and the environment.

Site risks summarized

A Public Health and Environmental Assessment (PHEA) was conducted to determine the potential threat to human health and the environment posed by contaminants present at the Warm Springs Ponds. The no-action alternative assessed in the PHEA assumes continuation of current site operations and conditions. The human health risk characterization of the site includes potential health effects that are both carcinogenic (cancer causing) and non-carcinogenic.

Health Risks

The contaminants of concern are inorganic metals such as arsenic, cadmium, copper, lead and zinc and their compounds. Potential human health risks from these and other contaminants were calculated using current and future residential, occupational, and recreational exposure scenarios involving contaminated media (soils, sediments, water) and contamination within the food chain (waterfowl and fish). The PHEA exposure scenarios defined the amounts of contaminated media that could be absorbed by quantifying each potential receptor/media/exposure pathway combination for the site. The scenarios assessed consider current site conditions and take into account potential future site developments (additional recreational use, new residential areas, etc.).

The maximum potential excess lifetime carcinogenic risks for all site media under the current recreational scenario is estimated to be 8×10^{-5} (eight chances in 100,000). The maximum potential excess lifetime carcinogenic risks for all site media under the current occupational scenario is an estimated 2×10^{-4} (two chances in 10,000). In other words, if assumptions concerning current occupational use are accurate, a worker at the site is subjected to increased cancer risks because of frequent and long-term exposure to the contaminated media. The increased risk is estimated to be two chances in 10,000 which is a high cancer risk by EPA standards. EPA considers acceptable a range of 1×10^{-4} to 1×10^{-7} (one chance in 10,000 to one chance in 10,000,000). The maximum excess lifetime potential carcinogenic risk for all site media under the future residential scenario is estimated at 2×10^{-2} (two chances in 100). No potential human health threat was identified from exposure to noncarcinogenic contaminants for the current recreational, the current occupational, or the future residential scenarios.

Under the current residential scenario, potential carcinogenic risks were identified only for the inhalation and ingestion of contaminated dust. At the town of Warm Springs, the excess lifetime cancer risk for dust inhalation or ingestion ranged from an estimated 1×10^{-6} (one chance in 1,000,000) to 1×10^{-5} (one chance in 100,000). At residences east of the operable unit, excess lifetime cancer risks due to dust inhalation or ingestion ranged from zero to 9×10^{-6} (nine chances in 1,000,000). No potential human health threat was identified from exposure to noncarcinogenic contaminants for the current residential scenario.

Environmental Risks

Under current conditions, the average concentrations of several site inorganic contaminants in surface water exceed Montana standards for the protection of aquatic life. The chronic toxic effects of site contaminants may be expressed in local fish and wildlife populations through reduced growth rates, reduced fertility, and increased mortality. A principal environmental impact associated with the operable unit is the periodic fish kills in the Clark Fork River. MDHES believes the kills result from the solubilization of metal salts from tailings in the Mill-Willow Bypass during summer rainfall events. Current effects on other local wildlife populations are unknown.

Future adverse environmental effects without remediation are expected to be similar to current conditions. Periodic fish kills can be expected to recur and chronic contaminant effects (reduced growth, fertility, etc.) may be expressed in fish and/or wildlife populations. The potential also exists for a catastrophic event (flood, earthquake) where the pond system berms could be breached, releasing site contaminants that could adversely affect aquatic resources (fish and wildlife populations, aquatic habitat) for miles downstream.

PUBLIC MEETINGS

Anaconda - Thursday, Nov. 9 at 7 p.m. in the Metcalf Center.

Missoula - Monday, Nov. 13 at 7 p.m. in the St. Patrick Hospital Broadway Building Auditorium.

Butte - Wednesday, Nov. 15 at 7 p.m. in the Mining/Geology Building, Room 206, at Montana Tech.

The Montana Department of Health and Environmental Sciences will hold three public meetings to discuss the options for cleanup of the Warm Springs Ponds operable unit of the Silver Bow Creek Superfund site as discussed in this Proposed Plan.

For more information, call Janie Stiles, MDHES, 1-800-648-8465, in Helena.

Ponds underwent careful study

In October 1984, MDHES contracted with MultiTech of Butte to perform a remedial investigation (RI) of the Silver Bow Creek site. The RI consisted of coordinated individual studies to develop data on the extent and severity of contamination within the entire site. This Phase I RI included a study of the Warm Springs Ponds.

In May 1987, MultiTech reported the findings of the Phase I RI conducted for the ponds. Upon completion of the Phase I RI, several data gaps were identified for which additional information was necessary before a feasibility study (FS) could be completed.

In February 1986, MDHES contracted with CH2M-Hill of Helena to complete Phase II RI/FS activities at the Silver Bow Creek site. Among the first investigations undertaken was the Phase II RI for the Warm Springs Ponds. Phase II RI activities began in October 1987 and CH2M-Hill reported the findings of the Phase II RI in May 1989.

As a result of all previous investigations undertaken, the following problems have been identified at the site:

1) Pond instability creates the potential for release of contaminated pond bottom sediments to the Clark Fork River during high flows, floods and earthquakes due to failure of the pond berms;

2) The tailings in and along the Mill-Willow Bypass are a source of high concentrations of dissolved metals and are the likely cause of fish kills in the Bypass and Clark Fork River during rainfall runoff events;

3) Tailings within the Mill-Willow Bypass continually erode and transport dissolved metals and sediment to the Clark Fork River;

4) Under normal flow conditions, the concentration of dissolved metals in Mill, Willow, and Silver Bow creeks and the Clark Fork River exceed those concentrations acceptable under State water quality standards;

5) The Warm Springs Ponds are ineffective in capturing tailings transported by Silver Bow Creek during high flows and floods. During these conditions a portion of the streamflow is routed around the ponds and transported to the Clark Fork River, untreated;

6) A groundwater contamination plume exists within and below Pond 1; and

7) There is the potential for unacceptable human exposure to exposed tailings and contaminated soils within the boundaries of the Warm Springs Pond operable unit.

Objectives of Ponds cleanup

The existence of environmental and human health problems within the operable unit directly correlates with non-compliance with applicable or relevant and appropriate requirements (ARARs) or unacceptable health risks. It is the ARARs and human health protectiveness standards which form the basis of remedial action objectives. Remedial action objectives are essentially site cleanup goals designed to address the problems identified at the site.

Based on the identified problems, the results of the Public Health and Environmental Assessment, and the analysis of ARARs, a list of remedial action objectives has been identified for all of the media at the site:

1) For pond bottom sediments, the remedial objective is to prevent releases of the pond bottom sediments due to floods or earthquakes. The Montana Department of Natural Resources and Conservation (DNRC) dam safety requirements have been identified as the applicable standard. The standard requires protecting the ponds to fractions of a probable maximum flood (PMF) and to the maximum credible earthquake (MCE).

2) For surface water, the remedial objectives are to:

- Meet ambient water quality standards established pursuant to the Montana Water Quality Act for arsenic, cadmium, lead, mercury, copper, iron and zinc at a "compliance point" just above the defined starting point of the Clark Fork River.
- Prevent ingestion of water within the operable unit above the Montana Public Water Supply Act's maximum contaminant levels for arsenic, cadmium, lead, mercury and silver, and above established reference doses for copper, iron, lead, zinc, and cadmium. Also, prevent ingestion of water containing arsenic in concentrations that would cause excess cancer risk greater than 10^{-4} to 10^{-7} (one chance in 10,000 to one chance in 10,000,000).
- Inhibit the migration of tailings from the Mill-Willow Bypass to the Clark Fork River in order to reduce the potential for future exceedances of ambient water quality standards in the Clark Fork River.
- Inhibit the migration of tailings from the upper reaches of Silver Bow, Mill, and Willow creeks to the Clark Fork River in order to reduce the potential for recontamination of the Mill-Willow Bypass and future exceedances of ambient water quality standards in the Clark Fork River.

3) For tailings deposits and contaminated soils, the

remedial objective is to reduce the potential for direct human contact, inhalation, and ingestion of exposed tailings and contaminated soils posing excess cancer risks above 10^{-4} to 10^{-7}.

4) For groundwater, the remedial objective is to reduce the levels of arsenic, cadmium, and other contaminant concentrations in the groundwater in the Pond 1 area to achieve compliance with Montana groundwater maximum contaminant levels.

Cleanup alternatives summarized

The remedial action alternatives that were developed in the FS to address the site problems just identified are described below. The numbering system used here is consistent with the numbering system used in Chapter 8 of the FS. The descriptions include the estimated present-worth costs and the timeframe that may be required to implement or complete the activity for each of the alternatives. In general, the alternatives are presented in order of their overall protectiveness in addressing the problems at the site; Alternative 1 being more protective and Alternative 7 being the no-action alternative.

In addition to the cleanup alternatives, the Superfund program requires that a "no-action" alternative be evaluated at every site. The no-action alternative serves primarily as a point of comparison for the other alternatives, but would only be selected if human health and environmental risks were found to be negligible. Based upon the risks present at the site, MDHES and EPA believe that all the media (surface water, groundwater, pond bottom sediments, and soils) require remediation.

Alternative 1 ($1,193,300,000)

The components of Alternative 1 include solidifying all on-site contaminated soils, tailings, sediments, and sludges to protect against a probable maximum flood (PMF) and a maximum credible earthquake (MCE); constructing a new treatment pond for surface water treatment and an upstream flood impoundment to capture flood flows for additional treatment; and installing a groundwater interception trench to capture and then treat contaminated groundwater as it migrates from the ponds.

The current inability of the three existing ponds to withstand floods and earthquakes would be addressed by using an in-situ (in-place) solidification process to stabilize the pond bottom sludges and sediments. This would minimize the risk of pond failure due to an earthquake or flood event. In addition, contaminated soils and exposed tailings which exceed an action level of 250 parts per million (ppm) for arsenic and 750 ppm for lead would be excavated and disposed of in the existing ponds prior to solidification. This alternative would effectively limit the toxicity and mobility of tailings to acceptable concentration levels and greatly reduce the potential for future human or animal contact with harmful contaminants.

Alternative 1 would also improve surface water quality with the construction of a new pond treatment system. A new treatment pond would be constructed to replace the existing, now solidified, pond system. The new pond would be capable of capturing and treating flows up to 600 cubic feet per second (cfs). This is the flow the current pond system is capable of treating.

In addition, an upstream flood impoundment (8,000 acre-feet) would be constructed to provide settling and treatment of flows on Silver Bow Creek up to the peak flow of a 100 year flood (4,000 cfs). Currently flood flows on Silver Bow Creek which exceed 600 cfs (the design limit of the Pond 3 inlet structure) are routed around the ponds, untreated. A flow of 600 cfs on Silver Bow Creek represents, approximately, a two- to three- year return flood.

The goal of the upstream impoundment is to prevent large quantities of sediments and dissolved metals from bypassing the pond system and flowing into the Clark Fork River. The impoundment would serve two functions. First, it would serve as a conventional sedimentation basin; as the velocity of the water entering the impoundment slows, the sediment being transported by the flow would settle out. Second, the impoundment would have the storage capacity to contain up to the 100-year flood. The water would then be metered to the ponds for treatment of dissolved metals, if necessary. Floods exceeding 4,000 cfs would be routed around the impoundment to protect it from damage due to overfilling.

Contaminated groundwater moving from the operable unit would be collected in an open trench constructed within and below Pond 1. The collected groundwater would then be pumped to the inlet of the new pond for treatment. This would reduce the discharge of contaminated groundwater into the Clark Fork River, and enable the aquifer to be used for drinking water and other beneficial uses.

Alternative 1 is one of two alternatives expected to exceed at least one ARAR. Whereas the DNRC dam safety standards require protection of the existing ponds 1, 2, and 3 to 0.2, 0.3, and 0.5 PMF, respectively, the in-situ stabilization process would provide protection of all three ponds against the full PMF. Alternative 1 is expected to meet all other ARARS with one exception; surface water standards for arsenic and mercury for protection of public health from ingestion of contaminated water and fish are technically

impracticable to meet using this or any other remedial alternative.*

The actions proposed in Alternative 1, however, would have a substantial adverse effect on existing wetlands. Over 1,200 acres of wetlands and open habitat for birds, fish, and mammals would be destroyed.

A potential adverse effect on an identified cultural resource within the area also exists. A concrete arch bridge located within the dry portion of Pond 2 has been determined to be eligible for inclusion in the National Register of Historic Places. Consultation with the State Historic Preservation Office (SHPO) would be necessary to minimize potential impacts to the bridge prior to commencing with any remediation activities. Consultation with SHPO will be necessary to address impacts to the bridge for the remaining alternatives as well.

Certain institutional controls will be required for Alternative 1 and all the other remedial alternatives, as well. Institutional controls are generally defined as legal mechanisms which prevent or limit human access and exposure to the contamination and are used to enhance the effectiveness of a given remedial alternative. For instance, domestic use of contaminated groundwater within the operable unit will be prohibited. In addition, upon solidification and closure of the ponds, the local zoning or land use authority and the EPA Regional Administrator must be notified of the type, location, and quantity of waste disposed of in each pond. A notation or deed to the facility property must be recorded in accordance with State law to notify any potential purchaser that the land has been used to manage hazardous waste. Finally, the prohibition against consumption of any fish caught within the Pond system must be continued.

Consultation with the Fish and Wildlife Service would also be necessary should a pair of bald eagles, which have previously nested within the area, return to the site. This follows for all of the remaining alternatives. The bald eagles are protected as an endangered species.

With the appropriate design, construction, and maintenance, Alternative 1 should reliably reduce human health and environmental risks. Because of the enormous volume of pond sludges (19 million cubic yards), in-situ solidification would not be completed for 17 years. Full risk reduction would not occur until that point. The estimated present worth cost for this alternative is $1,193,300,000. This present worth cost includes both capital costs and annual operation and maintenance costs. All future costs are reduced to present worth costs to allow remedial action alternatives to be compared on a relatively equivalent basis.

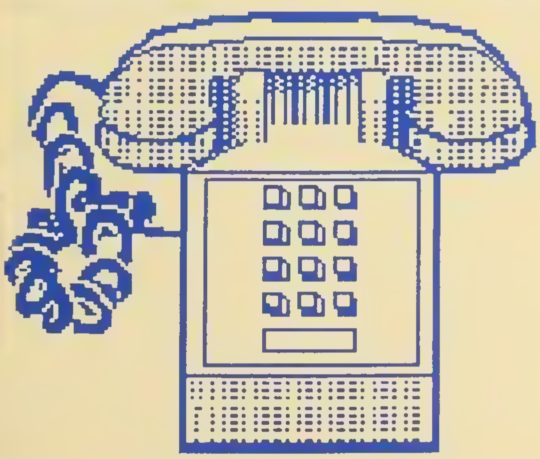
**The Montana ambient water quality standards for protection of public health from ingestion of contaminated water and fish for arsenic and mercury are below detection limits. Therefore, compliance with these standards by any remedial alternative is technically impracticable from an engineering perspective. These arsenic and mercury standards may have to be waived and the most stringent, technically practicable requirement imposed. For arsenic, MDHES and EPA are proposing a replacement standard of 0.02 milligrams per liter (mg/l) which is the current non-degradation standard. For mercury, MDHES and EPA are proposing a replacement standard of 0.2 mg/l which is the detection limit.*

<u>Alternative 2 ($258,300,000)</u>

Alternative 2 is the most comprehensive of the alternatives that retain the current pond treatment system. Its components include protecting the pond system against a probable maximum flood (PMF) and the maximum credible earthquake (MCE); excavating and disposing offsite all contaminated soils and tailings within the Mill-Willow Bypass, Pond 3, and below Pond 1; capping Pond 1; flooding exposed tailings and contaminated soils within Pond 2; and comprehensively upgrading the treatment system in Pond 3. It also includes two of the components of Alternative 1: constructing an upstream flood impoundment and installing groundwater interception trenches.

Pond stability would be achieved by protecting all three ponds against both a full PMF and MCE. Thus, maximum protection is provided against release of the pond bottom sediments. While some damage to the pond berms could still occur under extreme conditions, there would be minimal risk of losing the pond bottom sediments during an earthquake or flood event.

All exposed tailings and contaminated soils along the Mill-Willow Bypass, and all exposed tailings and contaminated soils within Pond 3 and below Pond 1 that exceed an action level of 250 ppm arsenic and 750 ppm lead would be removed and disposed of at an off-site Resource Conservation and Recovery Act (RCRA) disposal facility. The closest



TOLL-FREE SUPERFUND HOTLINE

If you have questions, comments or concerns about a Superfund site in Montana, or about Superfund, in general, please call our toll-free hotline. The hotline is in operation from 8 a.m. to 5 p.m. weekdays, except holidays.
In-state use only!

1-800-648-8465

RCRA permitted facility is near Boise, Idaho, approximately 480 miles from the site.

Exposed tailings and contaminated soils within Pond 2 would be flooded, and Pond 1 would be capped with a RCRA compliant cap. The RCRA compliant cap would be designed and constructed to minimize the escape of contaminants to the ground and surface water over the long-term. It would be designed to minimize the migration of liquids, minimize erosion or abrasion of the cover, and would function with minimum maintenance. All excavated areas and Pond 1 would subsequently be revegetated.

Alternative 2 would improve surface water quality by completely upgrading the current pond treatment system. The improvements would include the following seven measures:

1) Diverting Mill and Willow Creeks into Pond 3 for treatment;

2) Modifying the inlet structure to Pond 3 by adding a trash rack and overflow weir, and relocating the fuse plug;

3) Channelizing Silver Bow Creek through the dry areas of Pond 3 to minimize the interaction of Silver Bow Creek with exposed tailings and to control the direction of flow;

4) Improving the lime addition system to enhance metals precipitation;

5) Adding a berm across Pond 3 to help prevent short-circuiting of flow and thereby increase settlement of solids;

6) Constructing a new effluent structure in Pond 3 to minimize scouring and resuspension of pond sediments; and

7) Wet closing Pond 2 since the sludge storage capacity of the pond has been exhausted.

As in Alternative 1, an upstream flood impoundment (8,000 acre-feet) would be constructed to provide settling and treatment of flows on Silver Bow Creek up to the peak flow of a 100-year flood (4,000 cfs).

Contaminated groundwater would be collected through interception trenches located below both Pond 1 and 2 berms. The groundwater would then be pumped to the inlet of Pond 3 for treatment.

Alternative 2 is one of two alternatives expected to exceed at least one ARAR. Whereas DNRC's dam safety standards require protection of the existing ponds 1, 2, and 3 to 0.2, 0.3, and 0.5 PMF, respectively, Alternative 2 stabilizes all pond berms against a full PMF. This alternative is expected to attain aquatic and public health water quality standards for surface water (except for arsenic and mercury as described in Alternative 1), maximum contaminant levels for groundwater, and RCRA closure requirements for Pond 1.

All of the components of Alternative 2 should reliably reduce the human health and environmental risks at the site, if properly designed, operated, and maintained. The actions proposed may result in adverse effects to wetlands, endangered species, or historical resources. The estimated present worth cost for this alternative is $258,300,000. It is estimated that the remediation measures under this alternative will take five years to complete.

Alternative 3 ($62,500,000)
PREFERRED ALTERNATIVE

Alternative 3 is similar to Alternative 2 in that it includes protecting the ponds against an MCE, comprehensively upgrading the pond treatment system, capping Pond 1 and flooding Pond 2, and installing groundwater interception trenches. It is different from Alternative 2 in that it requires protection of the ponds to fractions of the PMF instead of the full PMF; it includes excavation of exposed tailings and contaminated soils with subsequent disposal in Pond 1 instead of offsite; and it includes the construction of a smaller upstream settling basin in lieu of a larger upstream impoundment. Only the new components are discussed below.

Pond stability in this alternative is achieved by protecting the ponds against fractions of the PMF. Pond 1 would be protected against a 0.2 PMF, Pond 2 against a 0.3 PMF, and Pond 3 against a 0.5 PMF. These are the standards that are required by DNRC dam safety regulations for high hazard dams the size of the Warm Springs Ponds.

In Alternative 3, all exposed tailings and contaminated soils in the Mill-Willow Bypass, and all exposed tailings and contaminated soils above Pond 3 and below Pond 1 which exceed an action level of 250 ppm arsenic and 750 ppm lead would be excavated and disposed of in Pond 1. Pond 1 would be closed with a RCRA compliant cap as described in Alternative 1. All excavated areas and Pond 1 would subsequently be revegetated.

Consolidating excavated material into Pond 1 under a RCRA compliant cap would effectively isolate the material from direct contact and effectively limit the mobility of the material. It would also effectively consolidate all material which exceeds the specified action level within a smaller area. As long as the cap is properly maintained, the material would be safe from release due to erosion of the cap.

The final difference between Alternatives 2 and 3 is that Alternative 3 includes the construction of a smaller upstream settling basin (2,000 acre-feet). During flood flows on Silver Bow Creek greater than 600 cfs but less than 4,000 cfs, surface water would be captured by the upstream settling basin. The settling basin would be similar to the upstream impoundment with two exceptions. First, the storage capacity would be much lower (2,000 acre-feet vs. 8,000 acre feet). Second, the amount of water that would receive full treatment for both suspended solids and dissolved metals would be less.

During flood flows between 600 cfs and 4,000 cfs, all

surface water from Silver Bow Creek would be captured by the upstream settling basin. Full treatment would be provided for floods that do not completely fill and then overflow the 2,000 acre-foot settling basin. Specifically, flows up to a 1,000 cfs peak flood on Silver Bow Creek lasting for a 24-hour period would be collected in the settling basin. Suspended solids would settle within the basin and the captured water would then be released slowly from the basin for treatment of dissolved metals in Pond 3, if necessary. Floods which exceed the storage capacity of the settling basin, however, would be only partially treated. For these floods, up to 80 percent of the suspended solids would continue to be settled out within the basin, but only up to 600 cfs of the flow discharged over the settling basin's spillway would then be treated in the ponds for dissolved metals. The remainder of the flows discharged over the spillway of the settling basin would be routed around Pond 3 and flow down the Bypass without treatment for dissolved metals.

The actions proposed in Alternative 3 are expected to result in compliance with all state and federal ARARs. These include DNRC dam safety standards, aquatic and public health water quality standards (with the exception of arsenic and mercury, as previously described), maximum contaminant levels, and RCRA closure requirements.

The actions proposed for Alternative 3 are technically feasible and are expected to reliably reduce the environmental and human health risks at the site. The actions proposed may result in adverse effects to wetlands, endangered species, or historical resources. The estimated present worth cost is $62,500,000. It is estimated that the remediation measures identified will take five years to complete.

Alternative 4 ($65,300,000)

Alternative 4 contains many of the same components as Alternative 3. These include protecting the pond system against a full MCE and a fraction of the PMF, capping Pond 1, comprehensively upgrading the pond treatment system, constructing an upstream settling basin, and installing groundwater interception trenches. The only difference between this alternative and Alternative 3 is that this alternative provides for capping exposed tailings and contaminated soils in place instead of excavating and consolidating them in Pond 1 prior to capping.

In Alternative 4, the only areas of exposed tailings and contaminated soils that would not be capped in place would be those along the Mill-Willow Bypass and within Pond 2. Material from the Bypass would be excavated and placed into Pond 1 prior to capping. The areas of exposed tailings and contaminated soils within Pond 2 would be flooded. All other areas which exceed an action level of 250 ppm arsenic and 750 ppm lead would be capped in place. The capping would involve covering these areas with a six-inch layer of agricultural lime to help prevent metals migration and then covering the areas with 18 inches of topsoil. Capping the contaminated soils and exposed tailings in place with an 18-inch cap would effectively reduce the mobility of the contaminants but would not be as effective or permanent in containing the wastes and minimizing the exposures as removal, consolidation, and placement under a RCRA cap as provided in Alternative 3. Fertilizer, soil amendments, and seed would be spread as necessary over the area to establish a stable vegetative cover in accordance with State reclamation requirements.

The actions proposed in Alternative 4 are expected to result in compliance with all state and federal ARARs. These include DNRC dam safety requirements, aquatic water quality standards (with the exception of arsenic and mercury), maximum contaminant levels, RCRA closure requirements (Pond 1), and state reclamation standards (exposed tailings and contaminated soils).

All of the components of Alternative 4 are technically feasible, and with appropriate design, construction, operation and maintenance, would reliably reduce the human health and environmental risks at the site. The actions proposed in Alternative 4 may have an adverse effect on wetlands, endangered species, or historical resources. It is estimated that implementation of this alternative will take five years at a total present worth cost of $65,300,000.

Alternative 5 ($61,700,000)

Alternative 5 is similar to Alternative 4 in all aspects except two. First, Alternative 5 includes a partial upgrade to the treatment system instead of the comprehensive upgrade provided in Alternatives 2, 3, and 4. Second, Alternative 5 provides for treatment of contaminated groundwater in an on-site wetland treatment system instead of in Pond 3.

The partial upgrade of the pond treatment system would include the following four measures:

1) Diverting Mill and Willow Creeks into Pond 3 for treatment;

2) Modifying the inlet to Pond 3 by adding a trash rack and an overflow weir and relocating the fuse plug;

3) Improving the lime treatment system; and

4) Retaining the existing effluent structures in Pond 3 and keeping Pond 2 in service.

This less comprehensive upgrade to the pond system would provide some improved treatment to surface waters, but not to the extent necessary to effectively treat flows up to 600 cfs as provided in Alternatives 2, 3, and 4. Consistent treatment would be provided for flows only up to approximately 210 cfs. This flow rate is based upon calculations which determine the maximum flow rate that could be metered from Pond 3 to Pond 2 while still providing acceptable metals removal in Pond 2 and preventing the resuspension of pond bottom sediments. Since the effluent structure which meters the flow from Pond 3 to Pond 2 will not be modified, Pond 2 remains an active treatment cell in the pond system and becomes a limiting factor with regard to the

volume of flow that can be treated in the ponds.

Because of the limited capacity of Pond 2, flows greater than 210 cfs would be directed around the pond system to the Clark Fork River without treatment for dissolved metals. This will result in violations of aquatic and public health water quality standards during above average flows. (The average flow of surface waters through the operable unit is approximately 90 cfs.) Also, because the effective treatment capacity of Pond 2 is nearly exhausted due to the volume of sediments accumulated in the pond, keeping Pond 2 in the treatment system provides an opportunity for sediments to be resuspended during periods of high winds. The future life of Pond 2, and therefore the future life of the treatment system would be limited to an estimated 15 years.

The groundwater contamination problem would be addressed by constructing a wetlands treatment system below Pond 1. Contaminated groundwater would be collected by an open groundwater trench and pumped up to the entrance of the wetlands for treatment. The area available for the establishment of a wetlands treatment system is approximately 100 acres.

Two separate treatment cells would be constructed within the wetlands to enhance the metals removal efficiencies. The cells would operate in series, with effluent water from the first cell discharging into the second cell. Treated water from the second cell would be discharged to the Clark Fork River.

Due to plant uptake of toxic metals and vegetation die-off, periodic removal of organic matter from the wetlands area would be necessary. However, with periodic cleaning and proper maintenance, the wetlands could be expected to remain viable for at least the life of the treatment system. Treating contaminated groundwater in an on-site wetlands should result in compliance with groundwater standards. However, wetlands treatment is not expected to be as consistently reliable, especially in the winter, as the pond treatment system proposed in Alternatives 2, 3, and 4.

Alternative 5 is expected to result in compliance with most, but not all ARARs. By providing only a partial upgrade to the pond treatment system, exceedences of aquatic and public health water quality standards can be expected. Compliance with maximum contaminant levels for groundwater is expected to be achieved, but not with the consistency expected with Alternatives 1 through 4. RCRA closure requirements for Pond 1 and reclamation standards are expected to be achieved. Montana floodplain management requirements will not be met.

The actions proposed in Alternative 5 may have an adverse effect on wetlands, endangered species, or cultural resources. It is estimated that this alternative will take five years to implement at a present worth cost of $61,700,000.

<u>Alternative 6 ($47,270,000)</u>

The components of Alternative 6 are a combination of many of the components found in Alternatives 1 through 5. Alternative 6 includes protecting the pond system against a full MCE and a fraction of the PMF, excavating tailings and contaminated soils within the Mill-Willow Bypass and disposing of them in Pond 1 prior to capping, partially upgrading the pond treatment system, and collecting and treating contaminated groundwater in an onsite wetlands treatment system.

The unique features of Alternative 6 are that 1) it does not include the installation of an upstream impoundment or settling basin, and 2) the action proposed for isolating the contaminated soils and tailings within the site includes flooding wherever possible. Only the two unique features are discussed below.

This alternative does not address the transport of contaminated soils and tailings from upstream sources except for flows less than 210 cfs. As discussed in Alternative 5, this flow rate is a limitation of Pond 2 and the partial upgrade of the pond treatment system. Therefore, flows greater than 210 cfs on Silver Bow Creek would bypass the pond system since no upstream impoundment or settling basin would be present to detain larger flows and thus, enhance settlement of solids and treatment of metals. Over the long term, deposition of tailings and contaminated soils from upstream sources may lead to recontamination of the Mill-Willow Bypass.

In Alternative 6, exposed tailings and contaminated soils below Pond 1 and within Ponds 2 and 3 would be isolated by flooding the areas and maintaining a constant water level. The flooding of tailings and contaminated soils below Pond 1 would be accomplished through the construction of the wetlands treatment system.

The flooding of exposed tailings and contaminated soils within Pond 2 would be accomplished by constructing a small berm across Pond 2, running east to west. This would facilitate the flooding of the higher southern end of the pond. A small amount of water would be discharged from Pond 3 to Pond 2 in order to keep the newly bermed area wet. Discharge from Pond 2 would flow directly into the Mill-Willow Bypass.

The actions proposed for Alternative 6 should result in compliance with some but not all ARARs identified. Because only a partial upgrade to the pond treatment system will be realized and an upstream impoundment or settling basin will not be constructed, compliance with aquatic and public health water quality standards will only be met at flows less than 210 cfs on Silver Bow Creek. Furthermore, Alternative 6 will not comply with Montana floodplain management requirements. Compliance with maximum contaminant levels for groundwater is expected to be achieved, but not with the consistency expected with Alternatives 1 through 4. RCRA closure standards and state reclamation standards are expected to be met.

The actions proposed in Alternative 6 may result in adverse effects to wetlands, endangered species or cultural resources at the site. It is estimated that Alternative 6 will take five years to implement at a total present worth cost of $47,270,000.

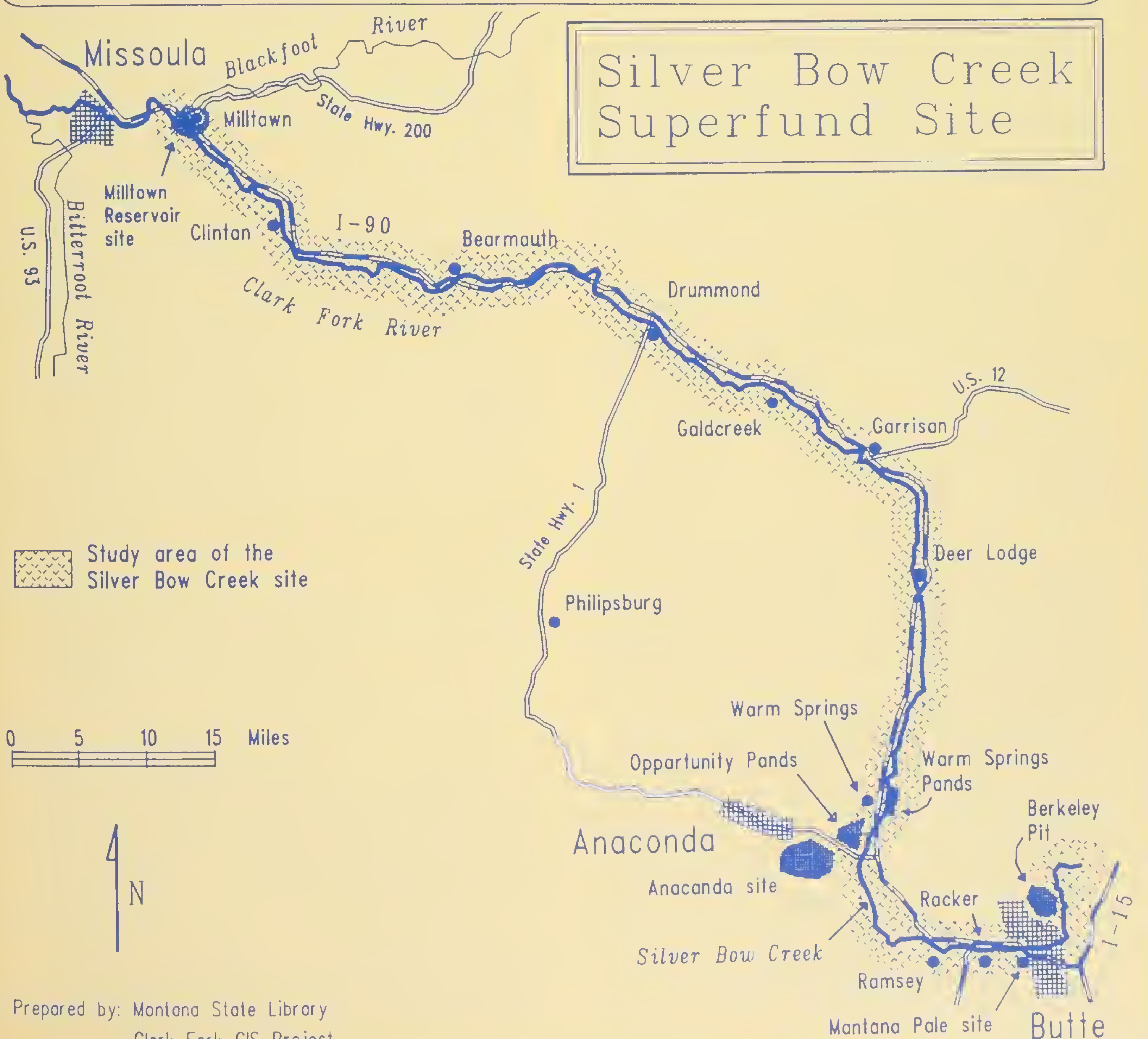
Alternative 7

Alternative 7 is the no-action alternative required by the National Contingency Plan, the federal regulations implementing Superfund. It is used as a baseline alternative against which to judge the other alternatives. As the name implies, this alternative does not include any remediation activities. Current activities at the site being carried out by the agencies would diminish substantially. The only activities assumed to continue are those being carried out by the owner (e.g., lime addition to the influent during winter months and general maintenance of the site). Accordingly, there would be no reduction in risk or increase in protectiveness of human health and the environment. As a result of the continued occurrence of a number of processes on site, the risks to human health and the environment would increase over time if left unmitigated. Major fish kills will continue to recur on a periodic basis. Catastrophic failure of the ponds could occur in a moderate earthquake or 100-year flood.

DON'T FORGET THIS DATE!

DECEMBER 29, 1989

Comments on this proposed plan and the Warm Springs Ponds Feasibility Study must be postmarked by midnight, Dec. 29, 1989, to be considered by MDHES. Please send your comments to Kathleen DeMarinis, c/o Montana Department of Health and Environmental Sciences, Helena, MT 59620. We need your thoughts on the remedy for the ponds.



Alternatives evaluated

MDHES and EPA have identified Alternative 3 as the Preferred Alternative to provide a permanent remedy at the Warm Springs Treatment Ponds as required by Superfund. As demonstrated in the following evaluation, Alternative 3 satisfies all statutory requirements and preferences, and is the most cost effective of the alternatives in meeting those requirements and preferences. The following evaluation profiles the Preferred Alternative against eight of the nine criteria developed by EPA to evaluate alternatives for compliance with CERCLA cleanup standards, and compares the Preferred Alternative to the other alternatives developed in the feasibility study. The one criteria not being evaluated here is public acceptance. This criteria will be evaluated in the Record of Decision following the public comment period.

Overall Protection of Human Health and Environment

All of the alternatives, with the exception of the no action alternative, would provide increased protection of human health and the environment. The Preferred Alternative would limit the mobility of the pond bottom sediments, improve the overall effectiveness of the treatment system, minimize the transport of tailings and dissolved metals to the Clark Fork River, reduce human and animal exposure to exposed tailings and contaminated soils, and collect and treat contaminated groundwater.

In the Preferred Alternative, as with Alternatives 4 through 6, the potential for release of pond bottom sediments to the Clark Fork River is minimized by stabilizing the ponds to withstand a maximum credible earthquake (MCE) and fractions of a probable maximum flood (PMF), as required by DNRC dam safety standards. Only Alternatives 1 and 2 would provide greater protection by stabilizing the ponds to withstand a full PMF, thereby exceeding required standards.

The potential for redeposition of tailings within the Bypass or for transportation of upstream tailings to the Clark Fork River is minimized by constructing a 2,000 acre-foot upstream settling basin. Of the alternatives developed, more consistent protection would only be afforded by Alternatives 1 and 2 which include constructing the larger 8,000 acre-foot upstream impoundment.

The potential for human and animal exposure to exposed tailings and contaminated soils is reduced in the Preferred Alternative by excavating all material which exceeds an action level of 250 ppm arsenic and 750 ppm lead, consolidating the material in Pond 1, and capping with a RCRA compliant cap. Capping exposed tailings and contaminated soils in place, as provided in Alternative 4, would effectively reduce the mobility of the contaminants, but would not be as effective or permanent in containing the wastes and minimizing the exposures as the RCRA compliant cap. Greater protection would only be achieved by solidifying the material as provided in Alternative 1. While off-site disposal, included in Alternative 2, would provide greater protection on-site, it would not reduce the toxicity of the excavated materials.

Compliance with ARARs

The Preferred Alternative and Alternatives 1, 2, and 4 will result in compliance with all the state and federal ARARs identified for the operable unit with the exception of surface water standards for arsenic and mercury. The Montana ambient water quality standards for protection of public health from ingestion of contaminated water and fish for arsenic and mercury are below detection limits. Therefore, compliance with these standards by any remedial alternative is technically impracticable from an engineering perspective These arsenic and mercury standards may have to be waived and the most stringent, technically practicable requirement imposed. For arsenic, MDHES and EPA are proposing a replacement standard of 0.02 milligrams per liter (mg/l) which is the current non-degradation standard. For mercury, MDHES and EPA are proposing a replacement standard of 0.2 (mg/l) which is the detection limit.

The actions proposed in the Preferred Alternative will meet dam safety standards for protecting the pond system against fractions of the PMF and the full MCE. The comprehensive upgrade of the pond treatment system in addition to the construction of the 2,000 acre-foot settling basin should result in compliance with ambient and point source discharge surface water quality standards at flows up to at least 600 cfs. Between 600 cfs and 4,000 cfs, up to 80 percent of the suspended soilds in Silver Bow Creek would be captured by the settling basin. Subsequent treatment of dissolved metals in Pond 3 would be possible for floods that do not completely fill and then overflow the basin. Specifically, flows up to a 1,000 cfs peak flood on Silver Bow Creek lasting for a 24 hour period would be collected in the basin and slowly released to Pond 3 for treatment of dissolved metals, if necessary.

The Preferred Alternative would also satisfy state groundwater and floodplain management standards. Excavating and consolidating exposed tailings and contaminated soils in Pond 1 prior to capping Pond 1 will comply with state and federal siting criteria for solid and hazardous waste disposal.

In contrast, Alternatives 1 and 2 would exceed the dam safety standards by protecting the pond system against an MCE and a full PMF. Also, compliance with ambient and point source discharge surface water quality standards would be achieved at flows up to 4,000 cfs with the construction of the larger, 8,000 acre-foot upstream impoundment.

Because Alternatives 5 and 6 provide for only limited improvements to the pond treatment system, regular violations of ambient and point source surface water quality standards will likely result for flows in excess of 210 cfs. Also, wetland treatment of contaminated groundwater may

not be as consistently reliable, especially in the winter, as compared to treatment in Pond 3. Finally, certain floodplain management requirements will not be met under these two alternatives.

Long-Term Effectiveness and Permanence

The Preferred Alternative addresses all of the identified risks at the site by including measures intended to limit or remove the risks. The primary risk at the site, the release of 19 million cubic yards of metal- contaminated tailings, is addressed by protecting the berms against failure from a full MCE and fractions of the PMF. Residual risks posed by the threat of pond failure would exist in only extreme cases.

All excavated tailings and contaminated soils would be consolidated in Pond 1 and capped with a RCRA compliant cap. Such a cap would be designed to minimize long-term release of metal-contaminated material to surface water and would minimize infiltration, thereby reducing groundwater imapcts. Maintenance and periodic inspection of the cap would be necessary to detect and prevent erosion or deterioration of the cap.

The 2,000 acre-foot settling basin will capture tailings carried down Silver Bow Creek during flows exceeding the capacity of the pond treatment system (600 cfs) to an upper limit of 4,000 cfs. It is expected that this basin will settle up to 80 percent of the solids flowing down Silver Bow Creek. The remaining 20 percent of the solids that are not captured by the basin could recontaminate the Bypass. This is considered unlikely, however, because the basin would settle out the coarser particles, allowing only the finer particles to reach the Bypass. The very fine materials that would not settle in the basin are unlikely to settle along the Bypass channel at flood flow rates. Subsequent treatment of dissolved metals in Pond 3 would be possible for floods that do not completely fill and then overflow the basin. Specifically, flows up to a 1,000 cfs peak flood on Silver Bow Creek lasting for a 24-hour period would be collected in the basin and slowly released to Pond 3 for treatment of dissolved metals if necessary.

The primary operation and maintenance requirements of the settling basin would be upkeep of the mechanical parts of the system and the removal of the settled solids to one of the operating ponds. Long-term, low-level contamination of the basin floor should be expected.

In Alternative 4, exposed tailings and contaminated soils would be capped in place with a reclamation cap. Capping in place would avoid the risks associated with excavation and consolidation in Pond 1, but may not provide for long-term protection and permanence to the degree afforded by consolidation under a RCRA compliant cap. Monitoring and maintenance requirements would be greater under Alternative 4 than Alternative 3 since each area with a reclamation cap would have to be inspected and maintained separately.

Because Alternatives 5 and 6 provide for continued use of Pond 2, there is greater residual risk of reentraining and releasing sediments in the pond during periods of high winds and flows. Within an estimated 10 to 20 years, Pond 2 would have to be taken out of service because it would continue to accumulate sludge and sediment and would be unable to provide acceptable treatment.

In Alternatives 5 and 6, groundwater exiting the pond system would be captured in trenches and conveyed to a wetlands for treatment. Wetlands treatment for metal removal is an innovative technology and its long-term effectiveness for treating the contaminated groundwater is unknown. Furthermore, the wetlands system is expected to result in recontamination of soils and sediments, and periodic removal of organic matter from the wetlands would be necessary, requiring ongoing maintenance.

Reduction of Toxicity, Mobility, Volume, Persistence, and Propensity to Bioaccumulate

In the Preferred Alternative, as in Alternatives 4, 5, and 6, the potential mobility of the pond bottom sediments is minimized by protecting the pond berms to the full MCE and fractions of the PMF. Only under extreme conditions would the containment of the pond bottom sediments be affected. The installation of an upstream settling basin will help to limit the potential of upstream tailings redepositing within the Bypass or migrating to the Clark Fork River. Although the potential mobility of the pond bottom sediments and upstream tailings is reduced, the volume, persistence, toxicity, and the propensity of the material to bioaccumulate will remain unchanged.

The comprehensive upgrade of the pond treatment system and the collection and treatment of contaminated groundwater provided in the Preferred Alternative will reduce the toxicity of the water leaving the operable unit. It is expected that the water will be treated to meet ambient, drinking water, and point source surface water quality standards consistently.

In the Preferred Alternative, exposed tailings and contaminated soils would be consolidated in Pond 1 beneath a RCRA compliant cap. This will reduce the mobility of the material and will also serve to prevent direct human and animal contact with the material.

In contrast, in Alternative 1, the pond bottom sediments and all exposed tailings and contaminated soils would be solidified and stabilized. Although the potential mobility of the material would be greatly reduced, an approximate three-fold increase in volume could occur due to the addition of large quantities of solidification agents. While Alternative 2 removes the threat of future mobility of tailings and soils at the operable unit, the material would continue to exist in an untreated state at the off-site disposal facility. Capping the tailings and soils in place, as provided in Alternatives 4 and 5, would reduce their mobility, but not to the extent provided by the Preferred Alternative, especially during high floods. Flooding these materials, as provided in Alternative 6, only reduces the mobility via the air medium.

Large areas of existing wildlife habitat would be destroyed from the solidification process provided in Alternative 1. Following solidification, the area would be

returned to wildlife habitat as dry, vegetated land, unsuitable for the same wildlife populations currently found there.

The partial upgrade of the pond treatment system as provided in Alternatives 5 and 6 would reduce the toxicity of water leaving the pond system but not to the extent provided by the comprehensive upgrades in Alternatives 1 through 4.

The wetlands treatment system provided in Alternatives 5 and 6 would reduce the toxicity of groundwater collected below Pond 1. However, treatment residuals from this process may require special disposal because of the increased metals levels in the soils and plants. The potential for surface water discharge of the contaminants would also increase through operation of the wetlands treatment system. Leaching of metals from the sediments may result in an increased groundwater problem in the area, although the magnitude or impact of such a problem is difficult to quantify.

Short-Term Effectiveness

The in-situ solidification process in Alternative 1 will require an estimated 17 years to complete. The actions provided in the Preferred Alternative and the other remedial action alternatives are expected to be completed within 5 years. The wetlands treatment system for groundwater, provided in Alternatives 5 and 6, would take approximately a year to develop. However, optimization of the system could take up to 5 years.

In the Preferred Alternative, as in Alternatives 2, 4, 5, and 6, remediation contractors would be at risk from direct inhalation of contaminants during foundation excavation on the berms and associated tasks. These risks would be controlled by using protective equipment as necessary. The overall level of protectiveness for these alternatives would not be attained until construction is completed.

None of the action alternatives are expected to adversely affect the community of Warm Springs during remediation. Local releases of metal-contaminated tailings or dust would likely occur during construction work carried out in contaminated areas, but such releases would be minimized by dust control techniques and would not be expected to affect the community. There is also the potential for short-term violations of the water quality standards as a result of remediation work in or adjacent to the Bypass and stream beds. Those violations could be minimized through use of temporary sedimentation barriers and sedimentation ponds.

Planning for all remediation activities undertaken should consider the potential impacts to a pair of bald eagles spotted in the area. The pair built a nest in 1987 but abandoned the nest in the Spring of 1989. If the pair reappears, disturbance would need to be minimized during the eagles' incubation period.

Implementation, Constructability, and Reliability

Most of the components proposed as part of the alternatives are well-developed technologies, used to some extent in either the hazardous waste, water, or standard civil engineering disciplines. The technical feasibility of these components appears to be good. The exceptions are the two innovative components included as part of Alternatives 1, 5, and 6: in-situ solidification (Alternative 1), and wetlands treatment for metals removal (Alternatives 5 and 6).

Protecting the pond berms against fractions of a PMF as provided in the Preferred Alternative and Alternatives 4, 5, and 6, would be more feasible than protecting the berms from a full PMF (Alternative 2) simply because of the magnitude of the project. Similarly, because the settling basin would be smaller than the upstream impoundment and would require fewer materials, its overall feasibility would be greater.

The Preferred Alternative and Alternatives 4 and 5 would require the acquisition of approximately 950 acres of rangeland for construction of the settling basin. Additional land acquisition would be necessary for the upstream impoundment provided in Alternatives 1 and 2. Because less land is needed for the smaller settling basin, it might be easier to implement.

The technical feasibility of in-situ pond bottom stabilization (Alternative 1) is not known for certain at this time. It has been used with success to solidify marshlands for foundation stabilization in Japan, but it has not been used previously at hazardous waste sites. Consequently, it has a greater risk of failure than any of the other components proposed for the pond bottom sediments. If it fails to solidify the pond bottoms, for whatever reason, additional stabilization of the pond berms (Alternatives 2 through 6) would be necessary.

Wetlands treatment (Alternatives 5 and 6) has been used with some success for removing metals loadings from acid mine drainage. Its technical feasibility is somewhat more defined than in-situ solidification, both of which are innovative treatment technologies. However, because effective wetlands treatment relies on the development of a resilient living ecosystem in the wetland, the implementation of an effective wetland could prove difficult and/or time consuming. The technical feasibility of the other groundwater treatment component, which relies on treatment in the pond system (Alternatives 1 through 4), is greater.

The offsite disposal option, proposed for the majority of the exposed tailings and contaminated soils as part of Alternative 2, would be more difficult to implement than the remainder of the contaminated soils options. Interstate transport of up to 1.5 million cubic yards of untreated waste would be administratively undesirable from both a transportation and disposal point of view. The onsite disposal options (Alternatives 1 and 3-6) would likely be easier to implement.

An apparent lack of locally available riprap will favor the alternatives that require smaller amounts of that material (e.g., Alternatives 3-6 over Alternatives 1 and 2). This will be significant especially if the material will need to be quarried specifically for implementation. Other materials and equipment are expected to be readily available for

construction.

From an administrative feasibility standpoint, all of the alternatives are about equal. Because of the unique nature of this operable unit, which has an existing permitted discharge, all seven alternatives (no-action alternative included) would require an MPDES permit to discharge water from the treatment system into the Clark Fork River. The discharge standards would be met for the Preferred Alternative and Alternatives 1, 2, and 4 because they include a more comprehensive upgrading of the treatment system. They would not be met with regularity for Alternatives 5 through 7. All seven alternatives will include some institutional controls, as well. These alternatives that utilize more or a wider variety of institutional controls will pose more administrative feasibility issues.

Cost

The present worth cost of the Preferred Alternative is $62,500,000. The lowest cost action alternative is Alternative 6 at $47,270,000. The highest cost alternative is Alternative 1 at $1,193,300,000. Alternatives 2, 4, and 5 have present worth costs of $258,300,000; $65,300,000; and $61,700,000 respectively.

Support Agency Acceptance

EPA has reviewed the FS and this Proposed Plan and concurs with the MDHES selection of the Preferred Alternative.

Preferred Alternative summarized

In summary, the Preferred Alternative is protective of human health and welfare, and the environment and is cost effective. The Preferred Alternative satisfies the statutory preference for remedies that employ treatment as a principal element to reduce the toxicity, mobility, or volume of contamination at the site to the maximum extent practicable. With the comprehensive upgrade of the current pond treatment system, both surface water and groundwater will be treated and their toxicity will be reduced.

The Preferred Alternative will attain federal and state requirements that are applicable or relevant and appropriate for the site with one exception: Montana ambient water quality standards for toxic or deleterious substances to protect public health from ingestion of contaminated water and fish for arsenic and mercury may require a waiver based upon technical impractability. The arsenic standard for water and fish ingestion is 2.2 nanograms per liter and the mercury standard is 144 nanograms per liter. Neither arsenic nor mercury can be detected at these levels with sampling and detection methods currently available. Because it is not possible to determine compliance with these standards, the remedy must meet the most stringent alternative standards that are technically practicable. MDHES and EPA are proposing a replacement standard of 0.02 mg/l for arsenic which is the current non-degradation standard. For mercury, MDHES and EPA are proposing a replacement standard of 0.2 mg/l which is the detection limit.

Based upon the information available at this time, the State and EPA believe the Preferred Alternative will be protective of human health and welfare, and the environment, will attain federal and state ARARs, will be cost effective, and will utilize permanent solutions and treatment technologies to the maximum extent practicable.

Glossary

Acre-Foot: The amount of water it takes to cover an acre of land with one foot of water; equal to 325,829 gallons of water.

Applicable or relavant and appropriate requirements (ARARs): Federal and state environmental laws which legally apply or are relevant and appropriate to site cleanup.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, nicknamed Superfund): The statutory program to clean up existing hazardous waste sites and to provide a response mechanism to clean up releases of hazardous wastes.

Feasibility Study: The study undertaken by the Montana Department of Health and Environmental Sciences, with EPA oversight and support, to develop and evaluate cleanup alternatives under Superfund. The feasibility study cleanup alternatives rely in part on data collected and analyzed during the remedial investigation.

Human health and protectiveness standards: Standards used to assess the adequacy of cleanup alternatives if ARARS do not exist or do not adequately protect public health and the environment. For example, cleanup standards for soil are based on the risk posed by exposure to contaminants in soil, becasue no federal or state law defines acceptable concentration limits.

Lead agency: The governmental agency with primary responsibility for coordinating response actions and/or enforcement activities at a Superfund site. MDHES is the lead agency for the Silver Bow Creek Superfund site.

Maximum contaminant levels (MCLs): Water quality standards adopted under the federal Safe Drinking Water Act which set maximum allowable levels of contaminants in drinking water.

Maximum credible earthquake (MCE): The most severe earthquake considered to be possible at Warm Springs Ponds

based on geological and seismological evidence.

Montana Water Quality Act: Montana law established to prevent, abate and control pollution of state waters to protect and improve the quality and potability of water for drinking, aquatic habitat, agriculture, recreation and other beneficial uses.

National Priorities List: The federal list of Superfund sites in the U.S.

No-action alternative: A cleanup alternative that involves taking no or minimal action at a site. A no-action alternative provides a basis from which to compare action alternatives by illustrating the risks to human health and the environment if no cleanup is conducted.

100-year flood: A flood magnitude expected to recur on the average of once every 100 years.

Operable unit: A portion of a Superfund site addressing either geographical area, specific site problems or other components of the site. The Warm Springs Ponds make up one operable unit of the Silver Bow Creek Superfund site.

Probable maximum flood (PMF): The most severe flood that may be reasonably expected in a particular location, as determined by a combination of regional meteorologic and hydrologic conditions.

Public health and environmental assessment: An analysis of quantitative and qualitative existing and potential human health and environmental risks at a site resulting from exposure to contaminants. The public health and environmental assessment is based on information gathered during the remedial investigation.

Record of decision: The document written by the lead agency which selects the alternative for site cleanup.

Remedial action: A response to, or cleanup of, hazardous substances at a Superfund site to prevent or minimize human or environmental exposure to the contamination.

Remedial action alternatives: Site cleanup options.

Remedial investigation: The study and assessment of the nature and extent of actual and threatened contamination at a Superfund site based on field investigations, laboratory analyses and data evaluation.

Resource Conservation and Recorvery Act (RCRA): A federal law which regulates treatment, storage and disposal of hazardous wastes.

Superfund: The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), amended in 1986 by Superfund Amendments and Reathorization Act (SARA). (See CERCLA).

Support agency: The governmental agency providing a review and consultative role to the lead agency at a Superfund site. EPA is the support agency for the Silver Bow Creek Superfund site.

Water quality criteria: Water quality characteristics that are expected to support and protect an organism, an organism community, or a prescribed water use or quality with an adequate degree of safety. Water quality criteria are not enforceable rules, but are used to derive water quality regulations.

Where to find site documents

The Warm Springs Ponds Feasibility study is available for public review in libraries along the Clark Fork and in Helena. Most libraries keep Superfund documents in their reference section. MDHES has recently placed the Administrative Record for the Silver Bow Creek site including the Warm Springs Ponds Operable Unit in the Missoula Public Library and the Montana Tech Library in Butte. The Administrative Record contains MDHES and EPA file information and documents which will help the agencies in making cleanup decisions about the site.

Following is a list of site repositories:

1) Montana Tech Library: located on West Park Street in Butte
2) Butte-Silver Bow Library: located at 106 West Broadway in Butte
3) Grant-Kohrs Ranch Office: located on Main Street in Deer Lodge
4) Mansfield Library: located on the University of Montana Campus in Missoula
5) Montana State Library: located in the Capital Complex in Helena
6) U.S. Environmental Protection Agency: located on Park Street in Helena
7) Hearst Free Library at Fourth and Main in Anaconda.

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